



NCCARF
National
Climate Change Adaptation
Research Facility

National Climate Change Adaptation Research Plans

Summary





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Disclaimer:

The views expressed herein are not necessarily the views of the Commonwealth, and the Commonwealth does not accept responsibility for any information or advice contained within.

Introduction



PRIORITY RESEARCH QUESTIONS FOR

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The Australian Government established the National Climate Change Adaptation Research Facility (NCCARF) in 2008 to lead Australia's research community to generate the information decision-makers in government, business and the community need to adapt to climate change – that is, to moderate harm and exploit beneficial opportunities arising from climate change.

A key responsibility of NCCARF is to develop National Climate Change Adaptation Research Plans (NARPs) for eight themes:

- » Emergency management;
- » Human health;
- » Marine biodiversity and resources;
- » Settlements and infrastructure;
- » Terrestrial biodiversity;
- » Primary industries;
- » Social, economic and institutional dimensions of climate change; and
- » Freshwater biodiversity.

Each Plan summarises the information required for sound decision making about adaptation and gaps in current knowledge, leading to identifying priority adaptation research questions and cross-theme adaptation research priorities for that area.

The Plans collectively provide a blueprint for investment in climate change adaptation in Australia over a five to seven year period. In addition to the original eight Plans, a ninth Plan is being completed focussing on adaptation research needs for Indigenous communities.



National Climate Change Adaptation Research Plans (NARPs) provide a blueprint for investment in climate change adaptation research for Australia for a five to seven year period.

Developing the National Climate Change Adaptation Research Plans

Each NARP is developed by a writing team of leading experts in the relevant field, coordinated and supported by NCCARF. Important inputs include the existing adaptation knowledge base (from research leaders), adaptation knowledge requirements (from key stakeholders and research end users) and review comments on the draft Plan (from all interested parties plus commissioned international experts). This information is gathered through several processes including workshops and a formal comment period for each draft. Adaptation Research Networks (ARN) play a leading role in generating researcher and stakeholder input to the development of the Plans.

Content

Each Plan includes several elements, in addition to the priority research questions for its theme area. The elements of a NARP include:

- » Interactions (synergistic, complementary or potentially perverse) between this theme and other themes;
- » Current knowledge on climate change impacts, vulnerability and adaptation;
- » Key end user information requirements for making decisions about climate change adaptation;
- » Priority research questions and cross-theme research areas; and
- » Implementation principles and strategies.

Key research issues and areas

Several research themes common to the Plans:

- » The focus of the Plans is adaptation, or actions that can be taken to moderate harm or exploit beneficial opportunities arising from climate change. NARPs are not concerned with climate science as such, and do not focus on research concerned with assessing climate change impacts or vulnerabilities, except where such information is required for adaptation initiatives.
- » Human dimensions of climate change, including social, psychological and belief factors, institutional behaviours, legislation and policies, and economic and financial considerations affect virtually all adaptation decisions, either in their formulation or their implementation. For this reason, research questions relating to these dimensions are included in most NARPs in addition to being the topics of a specific NARP (the Social, Economic and Institutional Dimensions NARP).



- » Adaptation to climate change will require many policies to be reviewed and reconsidered, such as policies guiding the introduction of species to areas where they are not currently present and general policies that guide conservation investments. This could challenge long-held policy directions in many areas of government activity and in business.
- » For some themes, climate change impact and adaptation is one of several important factors, and may not be the most significant factor in the short term. Incorporating sound knowledge about climate change adaptation, based on well-focussed research, at an early stage will normally reduce the ultimate cost and improve the effectiveness of climate adaptation efforts as well as contributing to broader desirable outcomes.
- » Uncertainty will remain a pervasive issue in assessing climate change impacts and developing adaptation initiatives. Adaptation will not be able to wait for perfect knowledge but will be implemented using the best knowledge available. For this reason, tools that enable good, but partial, knowledge to be used to develop adaptation initiatives are an important element of these plans.
- » Stakeholder involvement in research is promoted in NARPs for two reasons. Such involvement will provide insight to researchers about stakeholder and research end user knowledge requirements and the context within which research findings will be applied and will also help increase the extent and effectiveness of research uptake.
- » Research planning is concerned with adaptation to both incremental climate change impacts, for which incremental adaptation responses may be appropriate, and transformational climate change impacts, for which transformational adaptation responses may be required.

Implementation

The Adaptation Research Grants Program (ARGP) provides \$27 million for seed investment to support climate change adaptation research focussed on high priority research identified in the NARPs. The ARGP is administered by the Department of Climate Change and Energy Efficiency. Further investment to partner or match the ARGP funds is sought from other government bodies, research organisations, universities and other entities.

NCCARF has prepared Implementation Plans that outline the process for research calls. This usually involves an open call for research proposals through a process managed by NCCARF. However, for the Human Health NARP the National Health and Medical Research Council and for the Marine Biodiversity and Resources NARP the Fisheries Research and Development Commission, respectively, have contributed to the research funding and managed the research calls and projects for these themes.

Review and revision

Each NARP is to be reviewed and revised once during the period to June 2013. Reviews are conducted by a Review Panel comprising leading researchers in the theme, stakeholder representatives and a senior NCCARF official. Broad stakeholder input is sought at the beginning of the review process and draft revised NARPs are subjected to commissioned review by Australian and international experts. Revised NARPs will be available from the NCCARF website in addition to being published and circulated as printed documents.

Further information

Further information about National Climate Change Adaptation Research Plans, their implementation and review is available from NCCARF at www.nccarf.edu.au

Climate change adaptation and **emergency management**



Understanding risk

- » Where and how are changes in climate going to put us at greatest risk?
- » What tools are needed to enable decision making under future climate uncertainty?

Community and organisational resilience

- » What does community resilience mean in a changing climate?
- » What behaviours promote community preparedness and preventive strategies in a changing climate?
- » What are the most effective strategies to ensure that individuals, governments and the private sector adopt better practices in preparing for the increased risk to communities, business operations or critical infrastructure arising from climate change?

Adaptive strategies

- » How will climate change affect the emergency management sector's capacity to support preparedness, response and recovery?
- » What is the role of the private sector in adaptation through emergency management?

Regional implications

How will the climate change adaptive capacity of other countries, particularly those in the Pacific region, impact upon the Australian disaster management system and Australian fire and emergency service organisations?



Climate change adaptation and freshwater biodiversity



Incorporate climate change adaptation into management of freshwater species and ecosystems.

- » What management options will conserve freshwater species and ecosystems that are currently at or near their climate limits?
- » What attributes will enable freshwater species to adapt and ecosystems to successfully change autonomously in response to climate change?
- » How will climate change alter current freshwater biodiversity management effectiveness, and what management changes will be required, including for poorly understood species and ecosystems?

Identify climate change adaptation options for Australia's freshwater biodiversity refugia.

- » How can the climate resilience of freshwater biodiversity refugia be increased?
- » What changes to Australia's conservation reserve system are required to improve protection of current and projected climate refugia and to support connectivity for freshwater biodiversity?
- » What adaptation options will facilitate the type and level of connectivity and dispersal required under climate change impacts?

Understand climate change adaptation interactions between freshwater biodiversity and other sectors.

- » How will climate change impacts on other sectors affect existing stressors on freshwater biodiversity?
- » How can current non-climate stressors on freshwater biodiversity be managed or reduced to minimise the synergistic effects of climate and non-climate stressors?
- » What integrated climate change adaptation response plans at the local, landscape, catchment and regional scales will build the resilience of freshwater biodiversity, and also terrestrial biodiversity, primary industries, water resources and associated communities and industries?

Understand the role of environmental policies in protecting freshwater biodiversity under changing climate conditions.

- » How will climate change affect existing conservation goals, policies and programs for freshwater biodiversity including meeting Australia's international obligations?

Cross-cutting theme: Ensure that adaptation initiatives for freshwater biodiversity and other sectors are mutually supportive and integrated where appropriate.

- » What climate change adaptation and mitigation actions taken in other sectors will benefit freshwater biodiversity?

Climate change adaptation and **human health**

Heat

- » Which people are most vulnerable to short-term extremes of heat?
 - » Do levels of understanding of the nature of the risks, and personal/household-level ways to ameliorate them, vary between these population sub-groups?
 - » Are changes needed to mainstream public health policy?
- » Do early warning systems for heat waves and other extreme weather events reduce adverse health impacts?
 - » Which types of early warning systems are most effective?

Extreme weather events

- » Does public education about the risks of extreme events, and their avoidability, alter people's knowledge and behaviour?

Vector-borne diseases

- » What are the future risks of arbovirus diseases arising from climate change? This question should focus on population movements and changes in Northern Australia, and monitoring of potential vectors.
 - » Does climate-driven predictive modelling of any particular vector-borne infectious disease outbreak reduce the occurrence of such outbreaks?
 - » How would existing public health systems cope with increased levels of vector-borne disease infections?
- » Can meteorological forecasts of impending seasonal weather conditions provide useful advance warning of altered risks of vector-borne infectious disease outbreaks? Does such usefulness differ between human-only and zoonotic vector-borne diseases?
 - » Are such forecasts enhanced by inclusion of information about changes in environmental indicators (e.g. surface water conditions, vegetation levels, etc.)?
 - » Will the implementation of such early warning systems result in reductions in outbreaks or infection rates?

Food, air and water quality

- » Where will the likely climate change impacts on food safety and quality be observed and what measures/practices can be implemented to reduce the risk of food-borne disease outbreaks?
- » What is the role of water authorities responsible for treating water in the management of climate change impacts?





Mental health

- » What interventions are required to minimise the potential adverse mental health effects of natural disasters (such as drought, windstorm and floods)? Initiatives to address this question should build on the established models and frameworks in disaster mental health planning.

Community and Indigenous health

- » How might climate change and changes in occurrence of extreme events affect aspects of Indigenous culture and living conditions that affect health?
- » Which types of intervention most effectively increase the level of community resilience?
 - » What key characteristics of Indigenous, rural and urban communities determine their level of resilience to the stress of long-term changes in climatic and environmental conditions?

Health services and infrastructure

- » What models of integrating the entire health sector's adaptive responses best support co-ordination of adaptive activities?
- » What models of linkage and knowledge exchange between climate change researchers and policy-makers best provide relevant decision support in planning health sector responses?
- » What role should the primary healthcare sector play as part of a broader public health adaptive response to climate change?
- » Is the healthcare system adequately structured and staffed to handle increased demands from (a) extreme weather events, and (b) outbreaks of infectious diseases?
 - » What improvements are needed, feasible and effective?
- » What forms of in-career training of healthcare professionals best prepares them to identify and respond to climate-related health impacts?

Climate change adaptation and marine biodiversity and resources



Aquaculture

- » Which farmed species in which locations are most likely to be impacted by climate change?
- » What options are there for businesses to adapt to climate change effects either by minimising adverse impacts or taking advantage of opportunities? What are the barriers to implementing such changes and how might they be overcome?

Commercial and recreational fishing

- » Which fishery stocks, in which locations, are most likely to change as a result of climate change? What will those changes be (e.g., in distribution, productivity), and when are they likely to appear under alternative climate change scenarios?
- » What options or opportunities are there for commercial fishers in identified impacted fisheries to adapt to climate change effects through changing target species, capture methods and management regime, industry diversification, relocation or disinvestment?

Conservation management

- » Which ecosystems and species of conservation priority most require adaptation management and supporting research, based on their status, value, vulnerability to climate change and the feasibility of adaptive responses?
- » How should conservation managers and planners adapt their practices to ameliorate climate change risks and enhance adaptation options? What intervention strategies will increase system resilience and improve the time within which biological systems can adjust to a future climate?

Tourism and recreational uses

- » What are the predicted regional impacts of climate change for marine tourism assets (e.g., which tourism sites will be most vulnerable to change and to what degree?)
- » What is the adaptive capacity of the marine tourism industry and how can it be enhanced to cope with climate change impacts?

Cross-cutting issues

- » What are the key interactions across sectors, cumulative impacts and cross-jurisdictional issues that will affect the development of adaptation strategies in each sector and how can these cross- and multi-sectoral issues best be addressed?

Climate change adaptation and primary industries



Understanding and expanding adaptive capacity

- » What is adaptive capacity in the primary industries sector and how can it be measured and increased at individual, industry, regional and national levels?

Levels of adaptation

- » What factors define the effectiveness of different levels of adaptation response: adjusting practices, changing production systems, and transforming enterprises, industries and regions?
- » What information, knowledge, tools, programs and policies are necessary for primary producers and industries to identify the range of potential climate change adaptation responses and understand their benefits, costs, risks and opportunities?

Adjusting primary production practices and technologies

- » What types of improvements to production practices and technologies exist or could be developed to increase the adaptive capacity of Australia's primary industries, and what practical issues need to be addressed for implementation?
- » What adaptations could yield benefits from changing atmospheric and climate conditions, such as increased atmospheric CO₂ and changes in temperature and water availability?

Changing primary production systems

- » What characteristics of production system change in primary industries are likely to provide advantage under changed climate conditions?
- » What information, knowledge, tools, programs and policies are needed to support effective changes in primary production systems?

Transforming primary production

- » What characteristics of transformational change in primary industries are likely to provide advantage under changed climate conditions?
- » What information, knowledge, tools, programs and policies are needed to support effective transformative adaptation in primary production systems?
- » How can the well-being of individuals and communities unable to undertake transformational changes be maintained?

Integrating, implementing and reviewing adaptation

- » How can integrated climate change adaptation response plans be developed at the local, landscape and regional scales?
- » How can climate change adaptation requirements, options, benefits and costs be integrated with other information critical to primary producers and industries, and communicated to support successful adaptation being determined and implemented?
- » How can adaptation by primary industries be monitored and measured, including assessing synergies, maladaptation and interactions with other sectors, to support ongoing improvements to adaptation approaches and initiatives?

Climate change adaptation and settlements and infrastructure



Urban and regional planning and management

- » How can existing urban planning principles and practices accommodate climate change and the uncertainty of climate change impacts? How should these principles and practices differ, based on the location and spatial scale of the settlement? What can we learn about the adaptive capacity of settlements from responses to stresses in the past?
- » How can the governance of urban planning in Australia, including formal and informal rules, nationally consistent approaches and guidelines, and locally driven standards and outcomes, and the institutions responsible for decision making, be improved to facilitate planning processes and outcomes which incorporate adaptation to climate change?
- » What are the particular planning needs of remote and Indigenous settlements under a changing climate?

Built environment

- » What are the design options and principles for adapting new buildings to climate change in different locations, and how can these be implemented?
- » What are the design options and principles for adapting existing buildings to climate change in different locations, and how can these be implemented?
- » What are the full life-cycle costs and benefits of adapting the built environment and how can they be reliably estimated? Who will bear these costs and who will benefit? What financial and other policy instruments can be used to address the equity impacts of these costs?

Vulnerable coastal communities

- » How will demographic pressures and changes in different Australian coastal settlement types affect (i) potential impacts of extreme and gradual climate change, and (ii) current policy and regulatory settings which govern decision-making by government agencies, businesses and individuals? How will planning for coastal climate change impacts respond to local circumstances?
- » How well do we understand the relationship between climate and coastal processes? How can methods currently used to determine the physical risk on a regional basis of extreme inundation and coastal erosion from climatic and oceanic processes, either singly or in combination, be improved and new methods developed and applied?

Infrastructure

- » What is the vulnerability of infrastructure (individual and interlinked critical sectors) to existing and predicted climate change conditions at various spatial scales, considering average and extreme weather conditions? How can climate-induced service or structural failure thresholds for infrastructure and services be identified in light of the inherent uncertainty in climate projections?
- » What impacts on key infrastructure might have downstream or cascading impacts during extreme climate events, and how might these impacts be avoided?
- » What design standards for the average recurrence interval (ARI) and/or average exceedance probability (AEP), and planning periods for the various infrastructure components, should be adopted for particular locations and over what time-frames?

Cross-cutting issues

- » What would a climate-adapted Australian settlement look like?
- » What sectors of society are most vulnerable and least able to adapt to climate change in urban, regional and remote settlements? What is the nature of those vulnerabilities and the barriers to adaptation? How can physical, social, economic and institutional factors reduce their vulnerability and increase their adaptive capacity? At what spatial and temporal scales should adaptation responses for vulnerable communities be developed?
- » To what extent can geological/geomorphic/historical/traditional/local knowledge be applied to assessing vulnerability of existing settlements under different climate change scenarios?

The social, economic and institutional dimensions of climate change adaptation



The development and application of methods for assessing vulnerability and adaptive capacity that engage and harness the knowledge and skills of individuals, households, communities, businesses, industries and governments.

Identification of the capacity of individuals, households, communities, businesses, industries and governments to adapt to climate change, and of options to enhance this capacity.

Understanding the equity dimensions of current and future vulnerability and adaptation, including:

- » the issues for specific population groups who have particular vulnerabilities and limited capacity to adapt by virtue of their socio-economic status, skills, livelihood, cultural or linguistic background, or other characteristics such as age;
- » understanding the interaction between existing stressors and climate change, and the implications of this interaction for vulnerability and adaptive capacity.

Understanding the cognitive and affective dimensions of adaptation, including:

- » the knowledge, perceptions and emotional responses of people and groups regarding climate risks;
- » the time horizons of people and groups who make decisions about adaptation;
- » the degree to which people and groups feel empowered to adapt.

Understanding enablers and barriers to collective action, including:

- » how shared symbols, beliefs and practices enable or constrain adaptation;
- » how economic factors, including distribution of capital and investment, enable or constrain adaptation;
- » how social practices and opportunities enable or constrain adaptation;
- » how the distribution of power in decision making enables or constrains adaptation;
- » what differing types of decision makers consider to be the goals of adaptation (e.g., what defines 'successful' adaptation in their eyes);
- » what and how differing types of decision makers know about the vulnerability of others.

Measures to value adaptation. Understanding how to assess and value adaptations to climate change, including the value of opportunity costs, avoided damages, residual impacts, and benefits gained. This may involve:

- » reviewing and determining the suite of assessment and valuation methodologies that are most appropriate for use by Australian adaptation policy makers and decision makers;
- » identifying the limits to the use of these methodologies;
- » testing the identified methodologies against relevant current policy in Australia.

Analysis of existing responses from public and private institutions to climate change risks, and assessment of proposals to improve the effectiveness, efficiency and equity of future responses, including:

- » analysis of responses in the public, private and third (civil society) sectors;
- » analysis of the distribution of roles, responsibilities and capacities of different levels of government and cross-jurisdictional bodies;
- » understanding how laws and legal institutions, including regulatory instruments, support or impede adaptation planning and practice, and identifying reforms needed to reduce obstacles;
- » assessing the potential for, and limits to, market-based adaptation measures, including insurance markets.

Climate change adaptation and **terrestrial biodiversity**



National/continental-scale issues

- » How will climate change affect existing conservation goals and how should changed conservation goals be promoted and achieved?
- » How can the existing Australian legal, policy and institutional architecture for land management and biodiversity conservation respond to changes in conservation goals caused by climate change?
- » What conceptual models and long-term observation systems are needed to support the design, analysis and assessment of active adaptive management and policy experiments at regional and national scales under climate change?

Regional issues

- » What designs of landscapes in regions having different land uses confer maximum resilience for biodiversity in the face of climate change, including the uncertainty associated with future climate scenarios?
- » How will climate change interact with other key stressors such as fire, invasive species, salinity, disease, changes to water availability, grazing and clearing and what are the integrated implications for ecosystem structure and functioning?

- » How can large-scale carbon mitigation initiatives, such as revegetation and forest-related mitigation, be designed to maximise biodiversity conservation benefits and to avoid adverse impacts on biodiversity?
- » How can the major socio-economic trends occurring in many regions of Australia contribute to effective climate change biodiversity adaptation responses?

Local land management issues

- » What are the costs and benefits of different climate change adaptation measures in vulnerable ecological communities and ecosystems?
- » How should fire management adapt to climate change?
- » How can management of local protected areas incorporate and adapt to climate change?
- » How can we better integrate conservation plans and actions across landscapes, incorporating protected area management, off-reserve conservation measures and other land issues, in order to maximise biodiversity conservation benefits/outcomes under a changing climate?

Managing key species

- » Which species should be the focus of investment in climate change adaptation?
- » How will climate change affect current management actions for protecting priority species and what management changes will be required?
- » How will climate change affect current or potential problem species and what management responses will be required?





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